



United States
Department of
Agriculture

Animal and
Plant Health
Inspection Service

Plant Protection
and Quarantine

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2 May 2008

Dr. Robert V. Dowell
Director, Light Brown Apple Moth Eradication Project
CDFA Plant Health & Pest Prevention Services
1220 N Street
Sacramento, CA 95814

Dear Dr. Dowell,

Ms. Helene Wright, APHIS-PPQ State Plant Health Director for California, provided us with your request to have a trapping plan reviewed by the Technical Working Group (TWG) as an alternative control tactic for the light brown apple moth program. The plan was prepared by the Carmel, CA, organization named "Helping Our Peninsula's Environment", or "HOPE". We were working from a copy of that plan, apparently taken from a web page, dated 25 February, 2008. A critique of the plan was prepared by TWG members and is attached.

In short, we would not recommend using this plan or any similar plan in an attempt to control light brown apple moth populations. The basic premises of the plan are not consistent with the ways in which insect traps function in the field or mass-trapping functions as an insect control technique. Details are given in the attached document.

Sincerely,

A handwritten signature in blue ink, appearing to read "Victor C. Mastro".

Victor C. Mastro
Laboratory Director and Chair, Light Brown Apple Moth Technical Working Group



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TWG response to H.O.P.E.'s proposal to eliminate LBAM through trapping.

H.O.P.E. is proposing to use a trapping scheme to eradicate light-brown apple moth from California, or at least from the Monterey area. The TWG has previously discussed the possibility of trapping as a control method in specific, limited situations, but believes H.O.P.E.'s plan, as outlined, would not succeed. The trapping scheme described is not nearly sufficient to reduce the LBAM population.

Controlling insect populations by trapping ("mass trapping") has been studied in a number of insects (for a recent review, see El-Sayed et al., *Journal of Economic Entomology*, **99**: 1550 [2006]). In the case of LBAM, the traps would incorporate a synthetic version of the sex-attractant pheromone produced by female moths. As a result, they remove only male LBAM from the population – a method that is also sometimes referred to as "male annihilation". Like mating disruption, then, the HOPE trapping plan proposes to control the LBAM population by reducing the incidence of mating.

Theoretical considerations, as well as empirical data, indicate that a fairly high proportion of males must be removed from a population before mating will be measurably reduced. LBAM females typically mate once, whereas males will mate multiple times – basically, any time they can locate receptive females. If, say, only half or three quarters of males are removed from a population, the uncaptured males remain in the area throughout their lives and are available to mate any females that are present (note also that the presence of a male in a trap does not mean that he did not previously mate). Our experience with gypsy moth suggests that numbers of males captured reaches a maximum at about 1000 traps per square mile; that is, adding additional traps does not increase the total males captured in an area. This is about one trap every 50 m on a grid. However, reducing mating sufficiently for an eradication effort requires a trap density several times greater than that (6000 traps per square mile is generally recommended). The reason is that males must not only be removed from a population, they must be removed quickly, before they find a female and mate. Compared with male LBAM, gypsy moth males are arguably stronger fliers, so even greater trap densities would likely be required for LBAM control. With pink bollworm moths, similar trap densities are needed for control (2500-5000 traps per square mile).

While we don't have extensive data for LBAM relating distance from trap to percent capture, the data we do have, in conjunction with what we know of other species, suggests that, at the very most, only a few percent of males in an area will be captured using the standard detection grid of 5 traps per square mile. This is hardly sufficient to affect mating success. Increasing catch locally a few fold by placing four additional traps within 30 m of a positive trap also would not come close to reducing the number of males sufficiently to mating. H.O.P.E.'s statement that LBAM fly only 20-30 m in their lifetime (a statement the TWG does not agree with; see below) is in direct conflict with their presumption that traps (or small clusters of traps) that are hundreds of meters apart could remove enough males to reduce the population.

The TWG does note that H.O.P.E. suggested placing additional traps, on 30-m spacing, around any traps that caught males. If this were continued until the entire area between current detection traps was filled in with traps, the result would be a grid of ~3500 traps per square mile. That

density might possibly be high enough to reduce LBAM populations, although we would not propose that as a recommendation as we don't have enough data to know whether or not such a grid would be effective.

More specific comments on assumptions and details in the H.O.P.E. document:

The TWG does not agree with the statement: “. . . in an entire lifetime, the LBA moth only flies about 20-30 meters/yards away from where it was born, a maximum of 100 yards or about as far as you can throw a rock.” We're not sure where the 20-30 m figure came from but suspect it may have come from a study by Suckling et al. (*New Zealand Journal of Crop and Horticultural Science*, **22**: 225 [1994]), in which median distance from the point where marked moths were released to the trap where they were captured was 30 to 35 m, depending on trap type. As these were median distances, half of the moths flew further, and males were caught up to 600 m from the release site. In addition, as capture ends the life of the moth prematurely, those that were captured may well have dispersed further if they hadn't been trapped. In another study (Suckling et al., *Australian Journal of Zoology*, **38**: 363 [1990]), males were found to fly >400m.

“They [LBAM] also do not fly higher than about 10 feet above the ground.” This is simply not true. For example, in an ongoing study in New Zealand, traps have been arranged in a number of vertical transects in a forest at regular intervals from 1.5 to 17 m (roughly 50 ft) off the ground in a pine forest. Traps at higher levels have consistently captured more males than those closer to the ground. Because of this, efficiency of mass trapping could be reduced in areas with substantial vertical structure, such as relatively mature forests.

“The pheromone pesticide spray may have affected Monarch Butterflies or Smith's Blue Butterflies, but not likely target moths.” We don't know why this statement is in the document or where it came from. The TWG is not aware of any information on either of these species relative to the LBAM treatments, nor is there anything in the formulations that we would expect to have any effect on these species one way or the other.

H.O.P.E. opens the document with: “Aerial Spraying has been called the ‘least effective’ way to control the LBA Moth.” We're not aware of the source of this comment and don't agree that aerial application of mating disruption formulations is in fact the “least effective” way to control LBAM. We suspect that the following sentence, “99 percent of the Spray never has any effect on the LBA moth at all” is verbiage adapted from older literature regarding the use of more conventional (toxic) insecticides, in which case it is typically true that a very small proportion of what is applied to an area actually ends up on or being ingested by the target insect. In the case of mating disruption formulations, it is necessary to permeate the air with pheromone to the point that males have trouble finding females. Because the moths' senses are so finely tuned to the pheromone, very minute amounts of pheromone, if properly distributed, are capable of disrupting communication between males and females.

“There is a much better way to control the LBA Moth; **more effective, less cost and less public harm and alarm**” [their bolding]. If the TWG believed that there was a control tactic that, compared with mating disruption, provided a better balance of efficacy, cost, and safety, we would have recommended it. In the decades following the publication of Carson's *Silent Spring*

and the birth of Integrated Pest Management, scientists have worked diligently to identify and develop insect control tactics that are effective yet have minimal or no effects on human health, non-target organisms, and the environment. Mating disruption is one of the products of that work, and has proven effective against LBAM populations in Australia and New Zealand. The TWG is not aware of any data suggesting that aerially applied mating disruption formulations will cause any public or environmental harm and would not have recommended this tactic for widespread use in populated areas if it believed that doing so would place the public at risk.